Maine Department of Environmental Protection

Bureau of Land & Water Quality

O&M Newsletter

April 2006

A monthly newsletter for wastewater discharge licensees, treatment facility operators, and associated persons

Table of Contents

Water Treatment Affect on POTWs

The following is a synopsis of a presentation on the impact of water treatment plants and distribution on POTWs and the regulation of direct and indirect water treatment discharges.

The Federal Clean Water Act (FCWA, 1972, and later modifications, 1977, 1981, and 1987) established water quality goals for the navigable (surface) waters of the United States. One of the mechanisms for achieving the goals of the Clean Water Act is the National Pollutant Discharge Elimination System (NPDES) of permits, which is administered by the U.S. Environmental Protection Agency (EPA). The EPA has delegated responsibility to administer the NPDES permit program to the state of Maine.

Federal and state regulations require that effluent limitations set forth in a NPDES permit must be either technology or water quality based. Technology based limitations are based upon the treatment methods available to treat specific pollutants. Technology based limitations are set by regulation or developed on a case by case basis. There are currently no specific federal regulations for drinking water treatment plants. Water quality based limitations are based upon compliance with the Surface Water Quality Standards. The more stringent of these two limits must be chosen for each parameter of concern.

State law requires that the DEP regulate the discharge of toxic substances into State waters. Substances are deemed toxic if, singly or in combination, they can cause death, disease, abnormalities, cancer, genetic mutations, or physiological malfunctions or deformations in humans, fish or other aquatic organisms. Ammonia, some metals (i.e., copper, lead, zinc, arsenic and mercury) and chlorine are toxic to aquatic organisms at very low concentrations. Concentrations that protect aquatic organisms are usually much lower than concentrations to protect humans.

In 1998 and 1999 the legislature passed P.L. Chapter 722 and Chapter 500 to control the discharge of mercury. Point sources were required to sample their discharge using clean sampling techniques so that mercury could be analyzed at the ug/L level and discharge limits were calculated so that discharges would not discharge more mercury than as presently discharge. Pollution prevention plans were required to identify the sources of mercury and to implement source reduction. If a facility had a violation the plant would be required to implement a Toxicity Reduction Evaluation. Wastewater treatment plant found one source of mercury was the chlorine used for disinfection. Drinking water plant/distributors using chlorine for disinfection should have the chlorine analyzed for mercury contamination.

Numerical water quality criteria are numerical values set forth in the state Water Quality Standards. They specify the levels of pollutants allowed in receiving water while protective of aquatic life. Numerical criteria set forth in the Standards are used along with chemical and physical data for the wastewater and receiving water to derive the effluent limits in the discharge permit.

The Water Quality Standards for Surface Waters require that the effluent not cause toxic effects in the receiving waters. Many toxic pollutants cannot be detected by commonly available detection methods. However, toxicity can be measured directly by exposing living organisms to the wastewater in laboratory tests and measuring the response of the organisms. Toxicity test meets the aggregate toxicity of the whole effluent, and therefore this approach is called whole effluent toxicity (WET) testing.

The Clean Water Act directs the EPA to develop national industrial technology-based regulations to limit the amount of pollutants that are discharged to surface waters (usually called “effluent standards”). Pretreatment standards ensure that pollutants do not pass through or interfere with the safe and effective operation of these treatment plants. This includes interference with the beneficial use of sludge.

The EPA is beginning a new rulemaking to address direct discharge of drinking water treatment residuals to surface water, together with the indirect discharge of residuals to wastewater treatment plants. This rulemaking, titled “Drinking Water Treatment Effluent Guidelines” may include large, as well as medium and small drinking water facilities that discharge suspended solids, aluminum salts, organic matters, radio nuclides, iron salts, polymer, lime, arsenic, desalination concentrates, or other residuals.

Public comments on EPA proposed 2004 Effluent Guidelines Program Plan urged the EPA to develop effluent guidelines for drinking water treatment facilities. After considering all comments and gathering additional data, the EPA concluded that drinking water treatment facilities may be discharging more than trivial amounts of toxic and nonconventional pollutants. Accordingly the EPA selected the "drinking water treatment point source category" as a candidate for an effluent guidelines rulemaking.

Notice of Proposed Rulemaking is planned for August 2006. Final action must be taken by September 2007.

The term Significant Industrial User (SIU) is defined as: any industry subject to a categorical pretreatment standards; discharges greater than 25,000 gpd of process wastewater to the POTW; contributes more than 5% of the hydraulic or organic capacity of the POTW; or is designated by the POTW on the basis that the industrial user has the reasonable potential to adversely impact the POTW's operation.

Pollutants from drinking water plants that have a reasonable potential to adversely impact the POTW's operation include: settleable solids, chlorine, metals or pH.

The discharge of wastewater from water treatment plants (WTPs) to surface water requires a permit. No pollutants may be discharged into waters of the state except as authorized under a wastewater discharge permit. The process wastewater contains pollutants and WTPs are a point source discharge.

Water treatment filtration processes are typically removing dirt, water borne pathogens and small amounts of organic material from surface water or iron and manganese from ground water.

Some states have concluded that typical WTP discharge does not have a reasonable potential to adversely affect a POTW's operation or introduce pollutant that will interfere with or pass through the POTW, nor will it violate any pretreatment standard or requirement. Additionally, the discharge has about the same concentration of suspended solids as domestic wastewater, with lower BOD and fewer pollutants than domestic wastewater, and therefore, a state-based discharge permit will not be required for typical WTP discharges to POTWs.

Source water (raw water) may be either surface water or ground water and the typical processes associated with water treatment varies with the source of water. Typical surface water treatment applies filtration to remove organic and inorganic matter and to remove pathogenic organisms. Coagulation and flocculation are key to treating surface water. Typical ground water treatment precipitates dissolved minerals followed by filtration to remove the mineral and hence oxidation processes are key to treating ground water. Both treatment strategies apply filtration and filters lose their effectiveness as the filtrate accumulates and must be cleaned to avoid breakthrough and unacceptable head loss. Filter cleaning is accomplished by reversing the flow of water and backflushing the filter, producing wastewater composed of the filtrate and backflush water. The filtrate includes substances removed from the raw water as well as additives applied to enhance their removal and the backflush water may include additives such as chlorine. This wastewater is known as backwash and constitutes the majority of the wastewater discharge. The discharge of water treatment solids residual may impact the wastewater treatment plant.

Lagoon/settling tank treatment is relatively inexpensive form of treatment and is effective in significantly reducing the amount of solids that are discharged and provides some reduction in the amount of total residual chlorine (TRC). Lagoon treatment requires about one acre of land per each million gallons/day of production. Treatment provides over 90 percent removal of the solids, reducing the amount of settable solids from a range of 6 to 20 ml/L to less that 0.1 ml/L.
TRC is reduced as much as 1mg/L to 0.3 mg/L or less.

The effects of an inhibitory pollutant on plant biomass vary depending on how frequently and at what level the pollutant is discharged. The more consistently a pollutant is fed to the biological treatment process, the more chance the biomass has to develop a resistance to the pollutant. If a pollutant is fed at a fairly even rate and concentration the biomass will generally eventually become acclimated to the pollutant and BOD removal will no longer suffer. For this reason, a plant may experience operational problems unless there has been sufficient time for the biomass to become acclimated. In addition, discharges of toxics at high enough concentration can cause inhibition even in acclimated systems.

It is usually the intermittent discharge of toxics which produce the most drastic effects. These types of discharges may results from:

- Backflushing filters

- Spills of water treatment chemicals

The effects of industrial pollutants on a typical POTW can be eliminated or minimized through a number of measures initiated at the treatment plant. They can be generally categorized as:

- Biological process control
- Biological augmentation
- Chemical additions
- Operations modifications
- Physical modifications

The list is generally in order of increasing implementation difficulty, e.g., biological process control generally requires only minor changes in plant operation while physical modifications can include costly capital improvements.

Biological process control is generally limited to activated sludge systems, although some modifications to fixed film processes (e.g., trickling filters, rotating biological contactors) might be considered as a form of biological process control. An activated sludge system is generally monitored or controlled by utilizing one or more of three process parameters: mean cell residence time (MCRT), mixed liquor suspended solids (MLSS) and food to microorganism ratio (F/M). The biomass and its characteristics are

controlled by varying these interrelated process
parameters. The following changes to these parameters have been observed to mitigate the effects of industrial pollutants on an activated sludge system:

1. Increase the Mean Cell Residence Time. Increasing the MCRT (sludge age) has been shown to have the effect of reducing the inhibitory effects of all forms of toxic industrial contaminants. By increasing the MCRT at the first sign of a possible toxic upset, (by decreasing the solids wasting rate) the inhibitory effect of any toxicant will generally be less than if no action is taken.
2. Increase the Mixed Liquor Suspended Solids. High mixed liquor suspended solids (MLSS) concentrations have been shown to offset some of the effects of industrial pollutants. A high MLSS provides the best conditions for biosportion and acclimation to a toxic substrate. Increasing the sludge return rate to the aeration basin at the first indication of toxic upset, while at the same time diverting and storing any remaining toxic influent away from the aeration basins, will lessen the impact of a short term upset and cause quicker biomass acclimation to a long term problem.
3. Decrease the Food-to-Microorganism Ratio. This parameter is directly related to both the MCRT and the MLSS. It has been observed that decreasing the F:M causes improved biodegradation of toxic contaminants, and expedites biomass acclimation.

A further means of mitigating the effects of industrial pollutants on POTWs is through modifying the operation of existing treatment steps. Activated sludge systems are often designed to operate in several different modes (e.g., step aeration, contact stabilization, etc.) by providing the appropriate physical layout. Some modes of operation have been shown to be more successful than others at mitigating the effects of industrial contaminants, particularly those dosed in highly variable concentrations. It has been shown at the laboratory and plant scale that extended aeration and step aeration (step feed) are generally more resistant to upset than complete mix and conventional activated sludge.

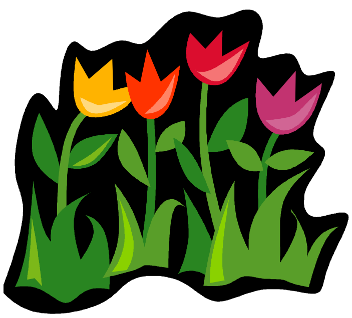
Pretreatment and source control of interfering industrial pollutants is the most direct and efficient way of mitigating the effects of industrial pollutants because the cause of the interference never reaches the POTW.

Setting local industrial discharge limits is one of the best and most direct ways of mitigating any industrial interferences that may exist at a POTW. Non categorical industries are not regulated by federal standards. Setting rational, technically based local limits in a fair and equitable manner is a sound approach to preventing interference. The General Pretreatment Regulation (40 CFR Part 403.3(c) require POTWs which experience pass through or interference to establish local limits.

A POTW should require industrial users to develop their own in-house Accidental Spill Prevention and the program should be reviewed for thoroughness and effectiveness by the POTW.

Enforcement actions for POTW interference or industrial discharge noncompliance are typically spelled out in the local sewer use ordinance, permits or contracts with industrial users or an approved pretreatment program.

Don Albert



Approved Training

April 12, 2006 in Orono, ME – Microsoft Access for Water and Wastewater Operators - sponsored by JETCC – 207-253-8020 – Approved for 6 hours

*****

April 26, 2006 in Saco, ME – Excavation & Trenching Safety - sponsored by WPETC (207) 729-6569 – Approved for 3.5 hours

*****

April 27 & May 4, 2006 in Old Orchard Beach, ME – Anatomy of Collection Systems: & NEWEA Collection System Voluntary Certification Grades I-IV Exam - sponsored by WPETC (207) 729-6569 – Approved for 10 hours

*****

April 27, 2006 in Bangor, ME – Excavation & Trenching Safety - sponsored by WPETC (207) 729-6569 – Approved for 3.5 hours

*****

April 27, 2006 in Lewiston, ME – Water & Wastewater Technology Seminar - sponsored by MRWA – 207-729-6569 – Approved for 3 hours

*****

May 3, 2006 in Freeport, ME – Residuals Management through Compound Loop Systems - sponsored by JETCC – 207-253-8020 – Approved for 6 hours

*****

May 9, 2006 in Topsham, ME – Excavation & Trenching Safety - sponsored by WPETC (207) 729-6569 – Approved for 3.5 hours

*****

May 23, 2006 in Bangor, ME – Care & Maintenance of Laboratory Equipment and Preparing for a Lab Audit - sponsored by WPETC (207) 729-6569 – Approved for 5 hours

May 25, 2006 in Waterville, ME – Identification of Filamentous Organisms in Activated Sludge - sponsored by NEIWPCC/JETCC (207) 253-8020 – Approved for 6 hours

*****

May 26, 2006 in Waterville, ME – Operation, Troubleshooting and Upgrade of Municipal and Industrial Lagoons - sponsored by NEIWPCC/JETCC (207) 253-8020 – Approved for 6 hours

*****

June 20, 2006 in Bangor, ME – Pump Stations O & M - sponsored by WPETC (207) 729-6569 – Approved for 5 hours

*****

July 18, 2006 in Saco, ME – Uniform traffic Control & Flagging - sponsored by WPETC (207) 729-6569 – Approved for 3.5 hours
*****
July 20, 2006 in Bangor, ME – Uniform traffic Control & Flagging - sponsored by WPETC (207) 729-6569 – Approved for 3.5 hours
*****
July 27, 2006 in Presque Isle, ME – Uniform traffic Control & Flagging - sponsored by WPETC (207) 729-6569 – Approved for 3.5 hours
*****
Note:
JETCC stands for Joint Environmental Training Coordinating Committee
MRWA stands for Maine Rural Water Association
MWWCA stands for Maine Wastewater Control Association
NEIWPCC stands for New England Interstate Water Pollution Control Commission
WPETC stands for Wright Pierce Environmental Training Center.

For Practice

1. If the supernatant from an aerobic digester has a high solids content, how will it most likely affect the activated sludge areation basin?
   a. Increase the DO level.
   b. Increase the MCRT.
   c. Increase the F/M ratio.
   d. Increase the removal efficiency.
2. The concentration of dissolved oxygen that may be held in water
   a. Increases as temperature increased
   b. decreases as temperature decreases
   c. is independent of temperature
   d. increases as temperature decreases
3. The type of solids that is the most difficult to remove using a standard biological treatment process is.
   a. Organic dissolved
   b. Inorganic dissolved
   c. Organic suspended
   d. Inorganic suspended

4. The best description of new activated sludge floc is
   a. Young, poor settling, underoxidized
   b. Young, good settling, clear effluent
   c. Old, rapid settling, overoxidized
   d. Old, poor settling, underoxidized

Spring 2006 Exam

The Spring wastewater operator certification exam, it will be given on May 10, 2006 in the usual locations. Those who have signed up for the exam should receive a conformation letter soon, if you have not already received that letter. If you do not receive a conformation letter by April 24th, contact JETCC at 253-8020.

Dick Darling

10th Biannual North Country Convention to be held in November

The biannual two-day training conference for operators in Northern Maine will be held this year on November 1st and 2nd in Presque Isle. As usual, 12 or more hours of approved training on a variety of topics will be presented over the two days. The North Country Convention has always been well attended by operators from the northern part of the state. It offers not only an opportunity to attend training sessions but also to meet with product vendors and exchange ideas with each other. For more information about the North Country Convention, contact JETCC at 253-8020

NEIWPCC/JETCC Sponsor training by Dr. Michael Richard

Dr. Michael Richard, internationally recognized expert in identification of wastewater treatment microorganisms and operation of wastewater treatment, will present two training classes at the Kennebec Sanitary Treatment District in May. Dr Richard will conduct a hands-on class on the identification of filamentous organisms on May 25th and a class on operations, troubleshooting and upgrade of municipal and industrial lagoon system on May 26th. These training classes are being sponsored by the New England Interstate Water Pollution Control Commission and JETCC. For more information, contact JETCC at 253-8020.

Answers to *For Practice:*

1. c – Solids carried over into the treatment system from the supernatant of a digester will be seen as food by the system and will increase the Food to Microorganism (F:M) ratio
2. d - The amount of oxygen that can be dissolved in water increases as the temperature goes down. Cold water holds more D.O. than warm water.
3. b - Biological treatment system can remove organic matter, whether dissolved or suspended. Inorganic suspended solids can also be removed through the physical settling in primary and secondary clarifiers. However, there is usually little or no removal of dissolved inorganic solids in a normal biological secondary treatment plant.
4. a - New activated sludge floc, which usually occurs during plant start-up, is young and therefore not very dense and it settles poorly. It is also underoxidized having had little time to react with the food in its surroundings.